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CONTENTS (Continued)

BULGARIAN, GDR COOPERATION IN PHYSICS, CHEMISTRY

Sofia BULGARIA TODAY in English No 6, 1978 p 20

[Article by Lilya Popova]

[Text] When I entered one of the laboratories of the Institute of Physics and Chemistry at the Bulgarian Academy of Sciences (BAS) I was not aware of the fact that its work was a stage of a long path. I only knew that this young team of senior research associate Roumen Vurbanov and the research associates Dobrin Nikolov and Ivan Mishkov under the leadership of the corresponding member of the BAS Professor Aleksei Sheloudko was laying the foundations of the essentially new elaborations in a field, very important for modern industry – flotation.

In fact, the long path started as early as 1960 when the foundations for cooperation in the field of physics and chemistry between the Institute of Physics and Chemistry at the Academy of Sciences in the GDR and the Institute of Physics and Chemistry at the BAS and the Chair of Physics and Chemistry at the Kliment of Ohrid University, Sofia, were being laid.

Many problems common to both countries have been solved by this cooperation. Ten years later the contacts already established were broadened. The team was joined by the Institute on Flotatión in the town of Freiberg. The two countries are using the latter's technical base for research and industrial tests. In this way their scientific co-operation was stepped up and the results are very favourable.

The flotation machine is already being used in Bulgarian industry, but it was produced in Freiberg, under the control of Bulgarian specialists. It will soon be introduced in metallurgy in the GDR. The invention has been patented in the USA, GB, France, the FRG, USSR, Czechoslovakia, the GDR, etc.

The specialists from Bulgaria and the GDR have yet another joint invention in the same sphere and it has also been patented. They have designed an installation for controlling the air intake of the flotation machines. It is a new, original method of flotation. This time the invention will first be introduced in the GDR and later in Bulgaria.

I met and talked to Prof. Sheloudko who also takes part in the joint projects.

'The successes scored are great and they belong to the scientists from the two countries. Our cooperation with Prof. Sonntag and Dr. Kretsch was of particular significance for the laboratory tests. Our successes are due to the fact that both countries have very aptly used the specific features of scientific development in this field in Bulgaria and the GDR and have managed to combine the advantages so as to obtain far better results.' I was told that this cooperation will continue.

CSO: 2020

INEFFICIENT UTILIZATION OF COMPUTERS CRITICIZED

Sofia STATISTIKA in Bulgarian No 2, 1978 pp 29-39

[Article by Yordan Bozhkov: "On Certain Questions Relating to the Utilization of Computer Equipment"]

[Text] At the contemporary stage of the country's socioeconomic development the necessity for rationalizing control and increasing the efficiency of management becomes a paramount problem -- an objective necessity dictated by the very nature of our socialist system.

For timely guidance, coordination and control of the complex and dynamically developing economic activity an enormous amount of information must be collected, processed and used and many versions of decisions must be prepared, by means of which the necessary measures for the optimum course of the entire productive process must ultimately be made. Parallel with the growth in the volume and complexity of production, the volume of information increases too. Unless measures are taken for the use of modern hardware for information collection, processing and presentation, production control becomes almost impossible.

The modern enterprise is a complex, dynamic probability system with a tremendous number of interrelationships and factors affecting it. They must be included and taken into account in the management process. This is possible only if information is available not only about the course of the production process in the enterprise, but also about the changes taking place outside it. This is how the matter stands with regard to the management of an enterprise taken individually.

More complex and multifacted still is the problem of the management of trusts, different sectors of the national economy and the economy as a whole. Consequently the effectiveness of management is increasingly more dependent on the state of the plant information system and the ability of managers to use it for making appropriate managerial decisions. Such an approach to management can be implemented only on the bases of extensive employment of electronic computer equipment and the establishment of modern

automated control systems (ACS). They, for their part, can provide the comprehensive information servicing of the managing bodies that are concerned.

These points were duly and farsightedly formulated by our party and personally by its first leader, Comrade Todor Zhivkov, as far back as 1968 in concrete resolutions adopted at the July (1968) plenum of the BCP Central Committe in "Main Directions for the Further Development of a System for the Control of our Society."

As far back as then it was decided "to establish a unified national information system which will organically merge the information systems of individual enterprises, organizations, departments, institutes etc. and which will harmoniously unify within it the different information flows." . . . "Electronic computer equipment will be introduced into the new information system on a broad scale."

In recent years considerable work has been done on the elaboration of the concept of a unified social information system (USIS) and its establishment, on the development and production start-up of electronic computer equipment, on the construction, equipping and opening up of computer centers, on the training of personnel for this new activity and the organization of work for the practical establishment of a few ACS and computerized data processing.

A number of government documents issued during this period regulated the introduction of computers into national economic control and the country's social control system. Thus, for example, the Decree of the Council of Ministers No. 27 of 6 June 1968 approved the program for putting computer centers into operation during the 1968-1975 period, and was considerably expanded by the Decree of the Council of Ministers No. 9 of 23 May 1970 and its amplification, Decree of the Council of Ministers No. 24 of 7 June 1971. These provided the necessary resources and approved the program drawn up for the establishment of ACS, full production-automation systems and the unified social information system.

The Committee on a Unified Social Information System now has an especially important, key place in matters of USIS and the employment of computer equipment in the country. It is to become a qualitatively new body and to provide full information servicing at all levels of social control. Territorial information and computer centers (TICC), locally, and the National Information and Computer Center (NICC) in the capital are the links through which the collection, processing and presentation of full information for all these levels are effected.

The outlines of the statewide network of computer centers are taking shape more and more clearly. The TICC are the backbone of this network. Along with the departmental computer centers, they constitute a solid materials-and-equipment backup of USIS nationwide.

Expensive computer equipment and highly skilled manpower are concentrated in computer centers. That is why -- quite in the spirit of present-day requirements -- the highest possible efficiency for both components must be assured. It must be achieved by skilled planning, systematic organization of the technological process, strict control and accounting, high productivity, reduction of downtime, preliminary organization of the work of designing, programming and getting into production, and the preparation of information carriers that will guarantee the avoidance of confusion, mistakes and delays.

A national conference of party, state, economic and public activists held at the end of January 1978, in addition to other problems, raised the problem of efficient computer utilization. It was emphasized that considerable funds have been spent to date for the purchase of computer equipment but the results of its utilization still do not correspond to the care bestowed by the party and state.

On the basis of data from statistical observation (organized and conducted annually since 1971), let us try to follow through and analyze certain aspects of the use of computer equipment in the country and draw a few conclusions and make a few assessments regarding its efficiency.

During the years of the Fifth Five-Year Plan and the first years of the Sixth Five-Year Plan we solved mainly organizational and personnel problems in the establishment and equipping of computer centers, personnel training and the organization of electronic data-processing operations. Not until the last few years did we make the transition on a larger scale to the specific introduction of computer equipment for data processing in varying fields, including problems in ACS and engineering calculations. The use of this modern equipment for the solution of problems in operative process control and full automation of production is still insignificant.

Existing Capacity

The establishment of computer centers and the delivery of new computers are taking place basically in accordance with the programmatic documents adopted by the government. Due to the several-fold higher rate of delivery in the past three years the total number of computers has considerably increased. An important new factor is the qualitative changes in the technical parameters of computer equipment. The machines are for the most part third-generation with processing capabilities much greater than the equipment previously delivered.

At the same time, in view of the fact that the average life of a computer is 4-5 years and that merely prior to 1972 about one-third of the total number of computers was imported, it becomes clear that a great many of them are technically and physically obsolete and should already have been replaced with new ones. Actually, the data show that so far only a few computers have been discarded.

On the other hand, we have a great diversity of makes and models of computers (more than 18 makes and 37 models), which by no means improves their adoption and efficient utilization.

The proportion which individual types of computers represent of the total number of machines, for example at the end of 1975, was as follows: ES [Unified System] 30 percent, ZIT [expansion unknown; possibly Computer Equipment Plant]-151, 23 percent, Minsk 13 percent, IBM 9 percent, Odra 4 percent, Fakom 3 percent and miscellaneous 18 percent. It is hardly necessary to prove how many difficulties the heterogeneous inventory of computers creates in designing, programming, maintenance, repair, operation, personnel training etc.

True, in recent years there has been a tendency to deliver machines of mainly the same type, thereby making it possible to avoid to a great extent the existing program, technical and operational difficulties in their utilization. Thus, for example, of the computers delivered in 1975 76 percent were Unified System, including models 1020, 1030, 1040. This tendency was reinforced still more in 1976 and 1977 by the appearance of even more improved models, for example the ES-1022.

More than half of the computers in the country now are of the Unified System, about 19 percent ZIT-151 and the remaining 30 percent miscellaneous makes and models.

This is obviously the only right policy which must be developed and confirmed even more in respect of the uniformity of computers -- one of the fundamental prerequisites for their efficient utilization, especially under conditions of USIS.

During the years of the Sixth Five-Year Plan and the first two years of the Seventh Five-Year Plan the concentration of computer equipment was intensified still more, with the greater part of computer centers and computers concentrated in such departments as the USIS Committee, the Ministry of Electronics and Electrical Engineering, the Committee on Science and Technical Progress, the Ministry of the Chemical Industry, the Ministry of Machine-Building, the Ministry of Transportation, the Ministry of Agriculture and the Food Industry, the Ministry of Domestic Trade and Services etc.

With the creation of the USIS Committee and the transfer to it of the stocks of materials and equipment of the territorial computer centers of the former "Automation" NPO [expansion unknown; possibly Scientific Production Organization], the committee now possesses very extensively developed computer-center resources. Counting the computers in Sofia, one-third of the country's machine inventory is subordinate to it.

The territorial distribution of computer centers and computers in the People's Republic of Bulgaria is not uniform but corresponds in large measure to the location and importance of the individual okrugs. Thus,

for example, at the end of the Sixth Five-Year Plan 42.7 percent of the computer centers and 47.2 percent of the computers were concentrated in Sofia. If we contrast these data with 1970 when 70.6 percent of computers were in the capital, we can draw the conclusion that there is a well pronounced tendency toward a more uniform territorial distribution in the okrugs.

The okrugs rank as follows in respect of the number of computer centers: Varna, Burgas, St. Zagora, Plovdiv and Veliko Turnovo with several computer centers each, the remaining 10 okrugs with two each, and 11 okrugs with one computer center each.

In respect of the number of computers the okrugs rank respectively Plovdiv, Varna, Burgas, St. Zagora, V. Turnovo, Pleven, Gabrovo and Ruse with several each, the remaining eight okrugs with two each, and 10 okrugs with one computer each.

Another important factor in computer utilization is the time standard for their introduction into operation and the achievement of a three-shift workload. Analysis of the data shows that the overwhelming number of computers delivered are promptly put into operation. But even so there are not a few cases where computers stand idle for a long time after they are delivered for various reasons despite the fact that there are definite standards of 3-4 months for getting them into operation. Thus, for example, during the years of the Sixth Five-Year Plan and the first years of the Seventh an average of 15-20 machines were not put into operation for a varying period of time: in 1971 18, in 1972 22, in 1973 14, in 1974 15, in 1975 18, in 1976 22. Especially striking, for example, are the cases in 1974 of the computer center at the Devnya Chemical Combine of the Ministry of the Chemical Industry where an "Elliott"-4130 computer stood idle for 49 months, and the computer center at the Petrochemical Combine at Burgas, likewise of the Ministry of the Chemical Industry, where an ASVT-M-3000 and an ASVT-M-1010 stood idle for 42 months. There was an analogous situation with the same machine, an ASVT-M-1010, for the computer center at the Chemical Combine in Vratsa. The ZIT-151 machines of the computer center of the Ministry of Transportation at Burgas and the Territorial Development and Exploitation Center with computer centers of the "Automation" NPO in the cities of Pernik and Burgas stood idle for more than two years.

The long period of time for which the machines stand idle, on the one hand, or are not used to capacity for several shifts, on the other, is due to a number of organizational reasons and above all to unfinished construction and installation work, lack of air conditioning, incomplete delivery of sets of computers and peripherals, inadequate design and software readiness, structural changes etc.

Obviously, much greater attention must be given in future by managements of the affected departments where computer centers are opened up and

computers are introduced. There must be increased demand for precise observance of the directives regarding the complete preparation of conditions and the standards for prompt introduction and efficient utilization of computer equipment.

Computer Utilization Rate

Provided that all organizational, technical and personnel preconditions are present, computers should be well utilized. On this question there are many and varying, often contradictory, data in the literature, but in final analysis they boil down to the fact that there is unquestionably a great difference between computer utilization in the United States and Europe. Whereas in Europe they are in service barely 10-14 hours a day, in the United States they operate an average of 22 hours. Another source points out that ordinarily computers operate 5-10 hours per day with a five-day work week in Europe, and 20 hours per day with a six- or seven-day work week in the United States.

In view of these data and the fact that our first computer was delivered in 1964 while in other countries this happened 10-15 years earlier -- time during which considerable experience was built up, we have to endeavor to catch up with world achievements more rapidly. We must not permit underutilization or idle time of this expensive equipment from which so much is expected. And if increasing the hourly workload of computer equipment is only one aspect, the second and even more important aspect is the functions with which the equipment is entrusted and the effect from the performance of these functions.

The indicators characterizing computer utilization over time enable us to determine the utilization coefficient of the computers that have been put into operation. Nominal available computer time, just since 1973, has been defined as six work days per week with the following shift-work norms: one shift for up to six months after coming into production, two shifts for up to 18 months, and three shifts over 18 months after coming into production, with a seven-hour daytime work shift and a six-hour nighttime work shift.

A significant proportion of the computer centers have made good progress measured by the attained rate of utilization of nominal time available. The best achievements in terms of the ratio of data-processing time to nominal time available amount to 80-90 percent and even (albeit in isolated cases) 96 percent.

At the same time there are a number of computer centers with an exceptionally low ratio of data-processing time amounting to hardly a few percent. Moreover, their number is by no means small. Attention should be intensified here; operational analysis of the reasons for this state of affairs should be used, and urgent measures taken for their elimination.

In view of the fact that nationwide an average 56.0 percent of effective time is used for data-processing, 14.3 percent for program-checking and testing, 1.6 percent for program maintenance and testing, and 1.5 percent for training, and 3.0 percent is incidental time for demonstrations, redoing of defective work and testing of magnetic tapes and disks, while nonproductive time is respectively 7.5 percent downtime due to technical troubles, 12.4 percent downtime for internal reasons, 1.2 percent down time for external reasons, 1.7 percent annual preventive inspection measures and scheduled preventive maintenance, and 0.8 percent reconstruction, modernization and expansion of the configuration, we can conclude that the proportion of nonproduction time 23.6 percent (downtime for various reasons) is still very great.

Obviously a much more thorough and specific analysis must be made of the structure of available time, on the basis of which appropriate measures must be suggested for the improvement thereof for departments, types of computer, specific computer centers and even individual electronic machines. The percentage of downtime in relation to available time nationwide has a tendency to decline, but still is very high: 1971 40.7, 1972 37.8, 1973 27.0, 1974 24.0, 1975 23.6, 1976 22.3.

Almost a quarter of the nominal time available is nonproductive. And considering that one-fourth of the computers use less than 50 percent of the nominal time available for data-processing, it can be seen how many unutilized capabilities there are in the time utilization coefficient of the currently operating computers. Here, clearly, urgent administrative measures are necessary.

Analysis shows that in 1973, for example, on the average nationwide a computer coming into use operated 11.2 machine-hours per day. This was a comparatively good achievement, but it was due, to a certain extent, to one group of machines operating stably on a three-shift system (some of these had changed over even earlier from the standard of two- and three-shift operation), and to machines having the capability and operating under multiprogram conditions.

The structure of nominal time available in individual years shows that a considerable proportion of time is still used for program checking and testing. Thus, for example, whereas data-processing time in 1971 was 43.8 percent of the nominal time available, program-testing time in the same year was 22.5 percent, in 1975 the former increased to 56.0 percent and the latter declined to 14.3 percent.

The high percentage of program-testing time in the first few years of the five-year plan is due to the lack of suitable software, the necessity of creating new programs, and insufficient experience on the part of programmers. The delivery and coming into operation of uniform makes and models of computers, the improvement in the skill of programmers, the expansion of the opportunity for active cooperation, and the sharing of

experience between computer centers in respect of the compilation of standard programs and packets of applied programs have contributed much to cut down this time. On this score priority goes now to the Central Planning and Program Library and to the Bulgarian-Soviet "Interprogram" NIPI [expansion unknown; possibly Scientific Research and Planning Institute].

In spite of everything else we must note that one of the most important factors on which effective computer utilization depends is software. A very serious analysis must be made of the software in existence and in use, as well as of the capabilities of the different areas to make full use of new software by training personnel in good time to utilize it.

Technical serviceability and stable operation are of especially great significance for efficient computer operation. They are unquestionably directly dependent on the quality of the computer equipment produced in our country and delivered from abroad and on the scheduling and performance of maintenance and repair of this modern equipment. Although much has been done not only in regard to the quality of the equipment that is produced and procured, but also in regard to maintenance service, downtime data indicate that there are still many unsolved problems in this sphere, too. Thus, for example, standby unattended time for a number of computers amounts to 40-50 percent of their nominal time available. That is why this question, too, must be given very serious attention by the bodies concerned since computer utilization depends, in final analysis, on its solution.

Here we must analyze the reasons more thoroughly: is it the low skill of personnel in computer maintenance and repair of the quality of the machines themselves, or both taken together. But the fact that the computers operate well at a number of computer centers suggests to us that perhaps the first reason is more probable.

The general conclusion that can be drawn is that the computer time-utilization coefficient has a tendency to improve, but there is still work to be done in this regard. Urgent and decisive measures must be taken to eliminate a number of weaknesses, improve operations and step up the rate of utilization of available computers.

Type and Volume of Work Performed

The distribution of effective computer time by types of functions enables us to see what computer equipment is used for. Although we still cannot speak of a very rational distribution since there are no strictly defined criteria, we must note that there has been significant progress on this score in this past period. Whereas in 1971 and the years of the Fifth Five-Year Plan preceding 1971 machine time was used mostly for problem-solving and data-processing, not including individual ACS subsystems, in the remaining years of the Sixth Five-Year Plan the volume of work done by computers

on ACS problems has grown from 34.4 percent on program-testing and 30 percent on processing in 1972 to 53.9 percent and 47.5 percent respectively in 1977. Despite this, the ratio of ACS problems to non-ACS problems involving processing has changed very slightly and is in the range of 50 percent. Consequently, half of processing time is used for the solution of ACS problems and half is still for the solution of non-ACS problems.

This tendency cannot completely satisfy us since the rate of change in the ratio is very low and does not meet the increased demands for the establishment of ACSs and full automation of production.

The availability of highly skilled personnel plays an extraordinarily large part in the efficient utilization of computer equipment. Personnel and personnel training are an especially important factor in the successful performance of the functions assigned to computer centers.

Analysis of personnel structure establishes that the proportion of workers (operators, mechanics and technicians, controllers) is the greatest and fluctuates in a range of 46.0 percent of total personnel. The proportion of engineers, designers and programmers is considerable. The ratio of designers and programmers is in the favor of designers, which has a favorable effect on improvement in design quality, but often holds up the preparation of programs for electronic data-processing. Of interest is the fact that despite the clearly pronounced tendency towards an increase in personnel during the period under observation, specialists with a higher education maintained a relatively constant level therein.

During the period under observation more than 80 percent of the total number of personnel took further training in various kinds of courses. In 1973 and 1974 the number of participants in specialized courses sharply declined, possibly signifying that there were enough well-trained specialists. The percentage of personnel taking programmer courses was especially large (over 25 percent).

Here, however, the question of the level of the courses that are conducted is critical. This is a problem that must be studied well and solved since the quality of design and program solutions in most cases is not up to the necessary standard.

Thus from a general analysis of the state of computer technology nationwide and its utilization rate the following conclusions can be drawn.

The establishment of electronic computer centers and the delivery of new computers is taking place with a certain lag as compared with the accepted documents and, more specifically, those for the Sixth Five-Year Plan, even though the available computer equipment in some instances is not being fully utilized.

In a number of cases there are considerable delays in putting expensive computer equipment into service and it stands idle for a long time for various reasons.

There are a large number of computers which are late in reaching their design capacity (the shift system defined by norms). A considerable percentage of the computers are technically and physically obsolete, have low technical parameters and need to be replaced. There are serious difficulties (software, hardware, operations) in putting computer equipment into service because of the great diversity and incompatibility of computer equipment. In the last years of the Sixth Five-Year Plan and the beginning of the Seventh a policy of uniformity had already been adopted (adoption on a large scale of computers of the Unified System).

A tendency is shown towards a more uniform territorial allocation of computer equipment in the country by okrugs and departments.

Although the utilization of available computer time gradually improves with every passing year, a considerable downtime loss occurs.

The job of personnel training, retraining and postgraduate training has been launched on a large scale, but the quality of training and the readiness of personnel to assume the work are not always at the necessary level.

Despite the existing concentration of computers in a few departments, we are not sufficiently turning to account the experience of the developed countries, and especially the experience of the USSR in creating and utilizing modern computer centers and high-power computer centers for collective use.

The introduction of computers and their use are often delayed by poor organization of computer repair and maintenance.

A number of reasons of an organizational nature also impede the rapid introduction and utilization of computer equipment. The necessary buildings and premises, air conditioning and other equipment are not always put into service within the specified normative time limits. Difficulties are encountered in the production and delivery of needed consumer materials.

The factors that most affect intensive computer utilization involve software and hardware. Modern software must be provided and created much more rapidly. Wider use must be made of packages of applied programs, economic-mathematical methods and algorithms for analyzing the results of production activity. More thorough work must be done to create and use modern technologies and efficient data-processing methods such as time-sharing, teleprocessing, automated data banks.

Obviously the Committee on USIS must delve more deeply into the analysis of computer equipment utilization and make available to superior party and state agencies more concrete and fuller information indicating what the actual situation is, broken down by sectors, departments and enterprises, must bring to light promptly the reasons for inefficient utilization of equipment and take effective measures to eliminate shortcomings.

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NEW TECHNOLOGICAL DEVELOPMENTS DESCRIBED

Sofia BULGARIA TODAY in English No 6, 1978 p 15

[Text] A highly effective Bulgarian catalyst has been developed for purifying exhaust fumes of carbon oxyde and hydrocarbons in various types of internal combustion engines – petrol, diesel or gas-engines. The purification is effected by means of an additional burning of exhaust fumes in a reactor, the filler in which is a catalytically active mass. The catalyst retains its high-level activity in a wide temperature range. The minimum temperature at which it is effective is 200 degrees Centigrade and an 80 per cent cleaning is effected at that; a complete, 100 per cent, cleaning is effected at a temperature of 300 degrees Centigrade. It is an important property of the new catalyst that it is not sensitive to catalytic poisons – plumbic compounds, sulphuric dioxide, etc., contained in engine fuels. If correctly used the catalyst can be active 1400 hours. It can be mounted either horizontally or vertically. Its size and construction vary and depend on the engine with which it is connected. The reactor can be mounted on the exhaust pipe and can perform its functions. The price of the original catalyst patented in Bulgaria is 1/2 to 1/3 that of the ones previously known in the world.

A complete technology for the production of light-sensitive plates for use in microelectronics has been developed in Bulgaria. Photo-plates are made by means of the evaporation of inorganic light-sensitive substances in vacuum. The thickness of the layer is very small – fractions of a micrometer owing to which all diffraction phenomena are avoided. The lack of a connecting substance accounts for their numerous advantages over conventional photo-plates – stability of images, rapid and easy development, accelerated drying. These photo-plates have a very promising future in practice.

The new Bulgarian regulator for irrigation systems has hydroautomatic legs for the distribution of water. Perforated subsoil pipelines were used in previously-existing regulators whereby the pressure of the water was 6 to 8 metres water column. As for the systems with hydroautomatic legs with regulators the minimal necessary pressure of the water is only two metres water column. It is possible to let water flow in several – 10 to 15 – out of nearly 100 furrows irrigated simultaneously, themselves receiving water from a subsoil

pipeline.
The regulators are made from plastics. Their wear and tear period is long and their cost low. They are used in the irrigation of vegetable-gardens, corn-fields, etc. The labour productivity of irrigation workers is 4 to 6 ha per shift.

Bulgarian specialists have evolved a new method of accelerating the hardening and increasing the strength of cement and concrete by means of a specific use of a new complex admixture comprising small quantities of plaster of Paris, lime and salts. Apart from the increase in their strength in initial phases, the strength of types of cement increases in a later phase when their grade increases by one too. On the other hand the rapid hardening of concrete makes it possible to attain a several times bigger rotation of shuttering sections. The method makes it possible to give up costly processing with steam whereby the use of cement per one cubic metre of concrete remains unchanged.

It is known that in many cases so-called 'ulcers' appear, under specific conditions, on the surfaces of cathodes during electrolytic copper-dressing. They appear as a result of the presence of gas bubbles on the surfaces of cathodes. This phenomenon is known as pitting. In electrolytic copper-dressing this leads to changes on the surface of cathodes whereby their quality deteriorates greatly. The 'pitting' also has a negative effect on a number of major indices – for instance on the coefficient of the use of current, on the use of electric power etc. A new Bulgarian invention makes it possible to do away with pitting on the surfaces of cathodes. It has been introduced into Bulgaria's non-ferrous metallurgy and specialists abroad are also taking a keen interest in it.

CSO: 2020

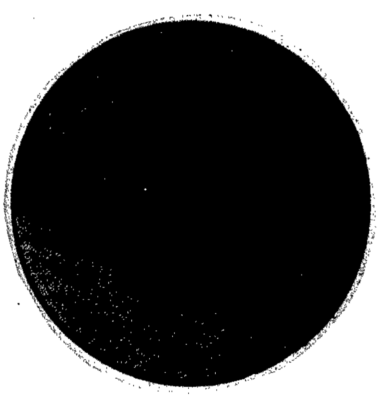
PROPERTIES OF 'BULGARI' MINERAL DESCRIBED

Sofia BULGARIA TODAY in English No 6, 1978 p 15

[Article by Lyudmila Pissareva]

[Text] At the beginning of the century the Russian mineralogist Academician A.E. Fersman said that one day mankind will surely find a way of making use not only of the mineral deposits known so far but of rocks as well. These words were an expression of an old dream. Nowadays many scientists from various countries are working on making this dream a reality. What has been acieved so far, however, is only a partial success.

... When one day several years ago the Bulgarian Ivan Borissov took in his hand a plain piece of rock and examined it, he little thought that his discovery would be of great benefit in the solution of this problem. There was nothing unusual about the case: a new batch of samples had arrived for examination at the petrography department in Sofia University where Borissov worked as an assistant professor. Since he was a specialist on magmatic rocks he had to examine them and make his conclusions. With this particular piece of rock he had difficulty. With some hesitation Borissov classified it as a hedrumite, which it resembled, nothing the differences. He found it hard to accept these differences and after making some additional investigations he concluded: The rock contained a high percentage of potassium oxide which is almost unaccountable for in nature – from 8.5 to 12 per cent and a high percentage of sodium oxide – about 4 per cent, aluminium oxide – 18–19 per cent, a classical type of spheroidal texture. Years passed until he was completely convinced that a similar rock had not been described. He drew a map of the deposits, stretching over an area of more than 32 sq km. Consultations with world-reknowned scientists confirmed what Ivan Borissov, now a professor and head of the Minerology and Petrography department at the Chemistry and Technological Institute in Sofia, had established: a new type of magmatic rock.



Traditionally, mineral deposits are named after the place where they were first discovered, says Professor Borissov. 'In this case it was not far from the village of Bulgarovo. This happy coincidence was a good reason for naming my 'offspring' BULGARIT which was my greatest dream – to associate the discovery with my country and with Bulgarian science.

Bulgarit has been recognized as an independent type of magmatic rock and has been listed in the international catalogues. Nevertheless, Professor

Borissov continued his investigations. As a result of continuous and thorough investigations he suggested how to use Bulgarit in a comprehensive manner. The technology was thoroughly elaborated at one of the Soviet Institutes where there was great interest in Professor Borissov's discovery. Opportunities have been created for the construction of an industrial complex in Bulgaria which would extract aluminium, potassium and sodium compounds and salts from the Bulgarit while the by-products will be used as a basis for the production of cement. The Bulgarit will be used in the production of tinted glass, faience, electrotechnical ceramics, potassium fertilizers, etc. The Bulgarit can be fully used without any waste-products.

No matter how significant the discovery of Bulgarit is, it is only one instance of the research work of Professor Borissov.

My main interests in the field of theory are the magmatic processes,' says Professor Borissov. 'Extremely interesting investigations are underway at the laboratory at our department. They give us reason to believe that we have established that both the original and newly-formed magmas always tend to form such a composition of two or more compoenents which melts at the lowest possible temperature. The first scientific contributions and publications have already been made and ouriefforts are presently directed towards providing new, direct and indirect proofs which would finally establish it as a new natural law. It will help to give a scientific interpretation to some unaccounted-for processes in space and on the moon in particular ...

The discovery of new rocks is an exceptionally rare event today. It has been commonly accepted that everything on Earth has already been discovered. However, sensations are possible. Such a sensation occured in Bulgaria.

CSO: 2020

ACADEMY OF SCIENCES BEGINS 138TH SESSION

Budapest NEPSZABADSAG in Hungarian 9 May 78 p 4

[Article: "Opening of the Plenary Session of the Academy--Scientific Session on Development of Agriculture and the Food Industry"]

[Text] At 10 o'clock on Monday morning the Hungarian Academy of Science started its work, its 138th session, in the conference room of the palace. For this important event of our scientific life there were present and sitting in the presidium Ovari Miklos, member of the MSZMP (Hungarian Socialist Worker's Party); Havasi Ferenc, secretary of the MSZMP's Central Committee; Szentagothai Janos, the president of the academy; Marta Ferenc, the Academy's first secretary; Pach Zsigmond Pal and Somos Andras, MTA (Hungarian Academy of Sciences) vice presidents; Kopeczi Bela, acting first secretary; as well as Romany Pal, minister of agriculture and food industry.

In his opening speech Szentagothai Janos reminisced about members of the academy who have passed away since the last meeting, with special praises for Csaki Frigyes, vice president, and Janossy Lajos and Ortutay Gyula. Those present held a minute of silence in memory of deceased members. Afterward the president of the academy spoke about the present session having at its center of interest another scientific debate, a matter which preoccupied a number of scientific minds, being of universal significance and giving rise to widespread discussion--and in which the role of science was fundamental.

Awarding of Gold Medal and Other Awards

In spite of the agricultural, social and structural changes that took place in Hungary in the last 3 decades, agriculture and the food industry were still of key importance. The importance of science, meaning here not only agricultural research but many other branches as well, in furthering agricultural development was probably even more evident here than in other economic branches. That is why the academy's 138th session looked toward emphasizing the role of science in the development of agriculture and food industry.

After this, the president of the academy handed out the academy's gold medal and the awards.

The gold medal of the presidium of the Hungarian Academy of Science for the year 1978 was awarded to the recently deceased academician Ortutay Gyula, president of MTA, Demography Research Group, for results obtained in Hungarian and academic demographic research and for long-time work in the academy's presidium on political science and scientific research. The gold medal was awarded by Szentagothai Janos to Ortutai Gyula's widow.

The following received academy awards: Farkas Vilmos, S. Hamori Antonia, Hexendorf Edit, Kiss Lajos, Papp Laszlo, Pusztai Ferenc, P. Hidvegi Andrea, Kiss Jeno, Zelliger Erzsebet, Zsilinski Eva, Bokonyi Sandor, Niederhauser Emil, Lovas Istvan, Katai Imre, Vanyi Andras, Palyusik Matyas, Danko Gyula, Szigeti Gabor, Dr. Somogyi Janos, Dr. Vizi E. Szilveszter, Vaita Miklos, Szepesvaryne Dr. Toth Klara, Kretzoi Miklos, Erdos Tibor, Bernat Tivadar, Bora Gyula and Fodor Laszlo.

Opening Address of Havasi Ferenc

Afterward in the name of the Central Committee of the MSZMP and of the Council of Ministers, Havasi Ferenc greeted the council:

"The session of the academy is always an outstanding social event. The influence of this highest scientific forum has always been of the greatest importance for the development of Hungarian science, and directly or indirectly, on the society's most varied activities. Over the last years there were several instances when leaders of the academy were consulted and gave their opinions on preparing for important political decisions. This experience, however, is not restricted only to the upper echelons of leadership. It is satisfying to see that the academy's agencies, the scientists and researchers, accept a more and more active role in solving our agricultural, public education, instruction and health problems. There is more and more initiative coming from scientists.

"One of the special consequences of the sessions has been the fact that barely 3 weeks after it, the decisons of the party's Central Committee's Eleventh Congress have been carried out and the most important tasks for the next term were pointed out. By preparing the balance of our work, the Central Committee also created favorable conditions for the conference to examine questions of scientific life and the most important objectives of scientific policy in the light of an evaluation encompassing all of our society."

Havasi Ferenc then continued, talking about economic and agricultural-political questions. He emphasized: "The main requirement of our progress is to alter our production structure in such way that it adjust better to our domestic data and international living standards. That is why preoccupation with this question is economic organization's permanent and fundamental task."

He went on to say that it is indispensable for business agencies to stimulate the economy and stop unproductive yields with all the means at their disposal. The formation of a modern production structure and the introduction of new, more effective technology make necessary a more active role by the science to bring about the realization of our plans. It is necessary especially to better explore the technical as well as agricultural research-development activities.

For this reason the Central Committee agrees that the highest branch of science, the MTA, should put on its agenda the question of agriculture and food-industry development and to make possible, with the tools given by science, the futhering of more vigorous efforts in the future.

Havasi Ferenc called to mind the fact that in June last year the higher party organizations, and in January this year the Council of Ministers, reviewed the situation on realization of the party's directives in scientific policy and also determined this year's tasks. "The most important action to follow now," emphasized the secretary of the Central Committee, "is to work out the tasks decided upon by all, and with this we should give a new momentum to readying the directives of scientific policy. The starting point, once we have decided on a line of action, is to say that the increasing demands on science may be met only by consolidating our psychological and material resources to meet the most important scientific and socioeconomic goals. Likewise in the area of scientific work we must validate step by step the effectiveness, requirements and put in the forefront the strengthening of the quality aspects of development. The new feature of our scientific policy is that we pay more attention to developing closer ties with the economic policy in order to bring about a more planned and speedier employment of research results.

"It is of fundamental interest not only for science but also for our social development that our country carry out high-caliber research and that our scientists and research centers be in the international current of scientific development. Pure research should take its required place and direction within structural research.

"There seems to be no important national task which would not count on scientific possibilities, which would not rely on scientific strength to solve our concerns and problems. We think that our aspirations are mutual and that the possibilities opened up by science will further improve our social and economic development as well as the progress of science for enrichment of man's culture. The work however which is necessary to bring this about requires that, first of all, you should go on considering your scientific work as a service, because the most beautiful and far-reaching legacy of science is to serve the people, "Havasi Ferenc, the MSZMP Central Committee's secretary, said in conclusion.

Presentation and Discussion

After the warmly received opening address, Academician Tamasi Istvan held a presentation entitled: "The Development of Agriculture and the Food Industry and the Tasks of Science." (We will return to a more detailed account of the presentation)

The first to give his views was Romany Pal, minister of agriculture and the food industry and after an intermission the debate started on Tamassi Istvan's presentation. Participants in the discussion were Kovacs Geza, university professor, Szalai Bela, state secretary of foreign affairs, Sipos Aladar, academician, and Keresztesi Bela, academician.

In the afternoon discussion several speakers emphasized the fact that research, with the coordinated efforts of the scientific fields involved, could effectively help the development of agriculture and the food industry.

The speakers urged a more thorough scientific examination of the economic problems encountered by agriculture and the food industry.

Several people spoke about the fact that, contrary to earlier opinions, the introduction of successful production techniques from abroad will not push to the background domestic research having the same goal. Altogether there were 11 who voiced their opinions.

Today the academy's session will continue its work with scientific discussion.

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CSO: 2502

ACADEMY CONCLUDES GENERAL ASSEMBLY

Budapest NEPSZABADSAG in Hungarian 11 May 78 p 5

[Unsigned article: The Academy General Assembly ends its work"]

[Text] The 138th General Assembly of the Hungarian Academy of Sciences [MTA] continued on Wednesday, discussing the addresses of President Janos Szentagothia and Ferenc Marta, executive secretary, on current tasks of scientific policy. The participants of the discussion agreed that the principle of selection has to be used more effecitvely when a research subject is chosen to reflect societal needs. Along with the goals, the size of material and intellectual resources has to be determined clearly. When the project is evaluated for starting, it should not be decided on the basis of pulling rank. The speakers also urged more active participation by the Academy in the preparation of research and development plans.

Discussion was broad on the contract research system which is a milestone in the work of the institutes. Several people said that experience shows this system allowing a more effective cooperation of theory and practice and the direct use of intellectual powers which acculated in research institutions. This leads to jobs that are several times more effective than the values fixed in the contracts. The speakers also agreed that the activity of the scientists in basic research is in vain when the willingness and capacity to accept the scientific results is lacking.

Seventeen people made their views known during the debate. After the concluding debates of Janos Szentagothai and Ferenc Marta the new officers of the Academy were elected by secret balloting. The new vice president of the Academy is Academician Jozsef Fulop, president of the Central Geological Office and professor at the Lorand Eotvos University. New members of the presidium include Academician Bela Szokefalvi-Nagy, dean at the Attila Jozsef University at Szeged and Academician Janos Prohaszka, dean of the Budapest Technical University. The General Assembly then voted a resolution.

The General Assembly confirmed the report of the presidium and the executive secretary then resolved the current tasks of the Academy and decided on the questions brought up by the presidium and the executive secretary.

The General Assembly resolved to create an ad hoc committee to access in depth climatic and environmental conditions as they relate to agricultural production. The committee, whose members come from the MTA, the Ministry of Agriculture and Food Industry, the National Water Bureau, the National Technical Development Committee, and other affected organizations, regards its task to produce proposals for better use of ecological conditions and new research topics.

The general Assembly urges the Academy's institutes to actively participate in the formulation of the Sixth Five-Year Plan and other long-term plans of the agricultural and nutritional branches because more effective utilization of research results is essential to the further development of agriculture and food industry. Finally, the General Assembly accepted the written reports on committee and branch activities and the organizational changes which occurred during the year.

This ended the work of the 138th General Assembly of the MTA. The class meetings associated with the General Assembly will be held in the next few days.

In closing the General Assembly, Janos Szentagothai, the president of the MTA said, among other things, that "although the class meetings associated with the General Assembly are still ahead of us, we can already say that the working sessions justified our hopes in them."

An extraordinarily vigorous and exciting debate was prompted by the talks given by Academician Istvan Tamassy on the scientific tasks facing the progress of agriculture and food industry and the related talk by Pal Romany, minister of agriculture and food industry. The opening talks, which were designed to generate the discussion, prompted 27 comments. The useful talk and debate, which gave a full picture of the scientific problems and tasks of the field, dovetailed those party and government resolutions that assigned the scientists the task of closer links with society's needs.

The basic task of the MTA continues to be the advancing of basic research but we should carry out those scientific jobs that are also socially and economically important. Basic research has to connect, in the end, to the great socioeconomic tasks.

"The debate showed," said the president of the Academy, "that our academicians receive the assignments stemming from the world's complex economic situation with great understanding and draw the appropriate conclusions."

"I find it very advantageous," Janos Szentagothai summed it up, "that just about every debater was concerned about how the results of science can be used more effectively in practice."

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CSO: 2502

SUGGESTOPEDIC METHODS FOR LANGUAGE TRAINING BEING USED

Budapest MAGYAR IFJUSAG in Hungarian 21 Apr 78 p 16-17

[Article by Dozsa Ildiko: "A London Letter from Kertesz St: in a suggestopedic Language Course"]

[Text] One dismal winter day seven women and seven men inconspicuously jumped into another skin: with changed names and occupations they began a new life lasting 5 weeks. The pharmacist, for example, spoke her broken English each morning in the role of the well-known singer Linda King. Zsuzsa, who was the youngest among us, ran through the irregular verbs as the actress Ann Chrygtal. From the newspaper reporter there appeared a doctor by the name of Robert Fox, and from the teacher a famous film producer Lucy Lukas. For all of this a major London congress served as the framework, whose name was "Man and Nature," while we would call the English-Hungarian scripts notebooks for the sake of the truth. At the start of the teaching only one motto was desired: "Let's learn English by playing," and the proceedings began.

The suggestopedic method worked out in Bulgaria has been in use here for about 4 years. From the 10 notebooks 2,000 words could be assimilated during the course--without cramming.

"I only ask that after lying down and before getting up at home you read over the lesson carefully twice," said the teacher, V. Remenyi Judit, the first day.

With student years filled with stormy events behind him, who would not take these words with suspicion? In school somehow it was hammered into you that there is no learning without study.

Let us name the introductory period. It is called a professional session. It consists of three parts, and its manner of assimilating the lesson is incomparably easy. Judit first read through the English text. Where necessary she complemented it with linguistic explanations and Hungarian translations. Meanwhile we looked at our notebooks. At the second reading only the English text was heard, with musical background. The third time we put aside our notebooks and listened with closed eyes and relaxed postures--no longer so much Judit's reading as--to the music of Haydn, Bach, or Tchaikovsky.

The English words in this section had to be (should have been?") recorded in our ears by themselves. And as the possibility was provided for the auditive types as well as the visual, we waited patiently to wake up from our nap with fluent English.

Almost all of us had some basis--a few months of study years ago. This made the first days easier. On the other hand those who knew other languages produced some amazing utterances in the practice conversation period following the introduction: instead of English the corresponding French, German, or Russian expression jumped in. But as soon as our English went beyond our German vocabulary, this blocking momentum disappeared. When, for example," we were glad if we grunted out something in English and did not mix it up with German.

The short linguistic part was hidden at the end of the notebooks. We played out on the basis of the "script" with more or less textual fidelity the interrelated episodes couched in the framework of the London conference. We already used with ease the simple future tense, and the continuous present thereafter when we read the explanation that went with it. It is true, Ann was not satisfied with speaking, but wanted to understand at all costs, and got so mixed up in a question that she sighed in doubt: "I'll be damned, I don't even know Hungarian anymore."

Being freed of linguistic drudgery, we became so spoiled that we accepted the approximately 80 irregular verbs begrudgingly. We whined that we had to study because we were advancing at a huge pace and had no time at home for studying. "How many words will we know at the end of this?" asked Ann skeptically, looking gloomily through the growing notebooks. "Everything," said Judit calmly.

"I tried to read the last lesson of a language book," Arthur reported enthusiastically the third week, "and, imagine, I understood!"

Thus we were tossed between doubts and in an interesting way our attention was turned to the fact that by the second lesson we could express our thoughts in English. Meanwhile the veil began to fall, in the half hour recesses we got to know each other: "What's your real name? Where do you work?"

"Klara, what do you think about it up to now?" I asked Irene O'Brien, an Irish writer.

"I'm just sitting here and letting them teach me," she answered, like the subject of a passive linguistic construction; or: Irene expects that she will be allowed to teach English. "As if Sanscrit would be easier," added the member of the group who had gone to India, and lit up a cigarette with resignation. The next day Judit heard with joy that Klara was reading Hemingway at home in the original...

It appeared from this that we simply did not want to believe that we could acquire knowledge without the accustomed teaching methods. Thereafter we

had a dual life there. In the afternoon we still came back to be the bearers of our own egos. Judit in vain warned us at first that for these 5 weeks we should abstain from mental and physical efforts. You cannot refashion your life all of a sudden. But every morning we complained in English in the course how tired we were.

"I'd like to get a foreign scholarship" Alan told us, "for that it would be necessary for me to speak the language. When I was with my brother in Africa it would have been good to know a little English, since I was cold in the Sahara without it..." he shared with us the painful memory, carelessly recalling the spirit of the cold.

According to the script, Roland had to get sick in bed. We worriedly inquired in English if his throat hurt, how high was his fever, and smothered him with advice. Judit was not able to take care that the continuous past tense should be in order with the interrogative forms. Then with an unexpected turn of events, the singer Linda took sick. Each morning she came to the session only to "sleep." She withdrew with a bad cold into the "sick corner" (because of the spread of the disease some of us were forced to use this separation), and listened to the new lesson in Jidit's reading and Haydn from the record player or whatever happened to be on the program.

"Push the chairs together," said Judit, "we're going by car to Oxford and then to Stratford to see Shakespeare's birthplace."

It was also natural that we wanted this kind of house, otherwise we could not get to it unless we drew it for ourselves. With a crayon. The work of the four draftsmen was of an unattainable advantage, as opposed to the childish scribbling of some of us. But we selflessly gave each one to Arthur, so he could arrange the exhibition according to the lesson where we were assembled jointly, and we heartily congratulated "our old friend" on the success of his painting.

Aside from the record player, the crayon, and the convertible chairs which were of key importance but neck-stiffening--relaxing in which we sometimes tried to take in the new material, sometimes transformed them into railroad cars and sped through the English countryside--we had two more important requirements: a polka-dot ball and a paper-petalled rose. The former Judit threw to us enthusiastically to the accompaniment of various English-language questions (for example, in literal translation: "Who has a cold?"). And having caught the ball one of us answered less enthusiastically: Ruth's husband has a cold. We did not throw the rose, but we pushed it into each other's hands with the greatest courtesy, trying to get rid of it as fast as possible. The one who still had the flower had to speak coherently either about the comfortable arrangement of Mr Douglas' house or about Ruth's husband's adventure at the North Pole. If we got tired, we sang, with Lucy's leadership, about Bonnie who was over the sea, about charming Billy boy who was looking for a wife, or about what hopes dwell deep in our hearts. At

the end of the course our flower got somewhat wet, its stem got bent from being pressed during tortured thinking. In the advanced course we composed an English ballad about the quiet withering of the rose.

We played 20 questions, wrote dictation, drew up letters and announcements, and laughed at every line as if we were schoolchildren. We acted out the titles of Shakespearean plays, and Peter at first could not explain Ophelia's drowning in English other than to say: "Ophelia died. She drank much water." Later Peter did not give up his favorite heroine. He began one letter like this: "Dear Ophelia, Here I am in London, I'm staying in the Park Hotel."...

One time we took our newly acquired knowledge of English out into life. With foresight that cannot be praised enough we selected the zoo as the scene of our exercise. We squeezed into the car in the possession of the group and tried out how it was to speak English in a real vehicle behind rolling seats. In Kertesz St Maria got into the Zsiguli, an actress, and Ruth Smith the mathematician got out in the City Park. In the true Hungarian smog darkening foggy Albion we favored the bears hanging around without an audience, and we did not even raise a great commotion when we discussed in English the color of their tails and their gloominess or the number of bars in their cage.

The end of our London stay approached. One thing was certain: Dr Fox was successfully identified with his role. I unexpectedly met him on the street, and I called to him from behind: "Hello, Robert!" Dr Fox turned around so matter-of-factly as if it were not on a Budapest sidewalk but in the recess of the congress that I called to him.

I think that hereafter any one of us would be happy if fate were to bring him to England's shores: in the literary language used by radio and TV he would be able to make himself understood linguistically perfectly. He could go shopping, order food and drink, inquire after streets, and the polite English would show no surprise if he suddenly began to chat about environmental pollution, or if, in the spirit of the congress entitled "Man and Nature," he demanded the immediate execution of measures in the interest of clean fresh air. And you should not be surprised if by chance you should hear them call out on the bus: "Hello, dear Linda!" and then in mildly accented but truly literary English they were to have an excited conversation about the weather. We will be those people.

In summation I can tell, with all of them, that the congress concluded successfully. It was educational, and I can only propose that you try it yourself. We invite you sincerely, I mean, Shirley Burton, reporter from Birmingham.

8419
CSO: 2502

AUTOMATED PROCESS FOR CRYSTAL GROWING DEVELOPED

Budapest MUSZAKI ELET in Hungarian 2 Jun 78 p 5

[Excerpts] For some time the Central Physics Research Institute of the Hungarian Academy of Sciences has been engaged in developing a bubble memory which can be attached also to the TPA computer. The medium of this memory is a synthetic precious stone single crystal, gadolinium, gallium, garnet--or GGG for short. Availability of the aforementioned essential crystals in sufficient quantity and uniform quality so that research in bubble memories can reach the stage of realization can be achieved only through automated crystal growing. This task was brilliantly solved in the course of a few years at the Institute. After 1974 the physicists of the Central Physics Research Institute were not only keeping pace with international developments in the field but had selected the best approach to the problem. Of the methods for growing crystals from solution, they chose the Czochralski method. However, this method calls for constant supervision and control, often for several days at a time. When monitoring personnel were relieved, replacement of them often led to changes in crystal quality.

The automated method evolved at the institute completely eliminates such subjective factors from crystal growing. Unexpected changes can be corrected at once. The essence of the procedure is that the crucible containing the solution is placed on an electronic scale having a sensitivity of at least a tenth or even a hundredth of a gramm. This reveals precisely to the computer monitoring and controlling the process the rate at which the substance in the crucible is being depleted and at what rate it is growing onto the developing single crystal. The computer also records such factors as atmosphere, temperature distribution within the solution, the speed of core extraction and rotation.

Thereafter physical and chemical investigations are made of the characteristics of the new single crystal. Next the technology of growing is modified through change of various factors until an ideal crystal is obtained. These modifications and efforts at change are continuously monitored and the results recorded by the computer. Subsequently, the computer needs only to control the technological process in such a way that the conditions

which produce the desired result are reproduced. All possibility of human inaccuracy or error is eliminated; requirements for reproducibility are met. Furthermore, the crystals grow in very good cylindrical shape which make them easier to work.

The automatic system which the physicists of the institute fabricated for this prupose and only one element of which, the scale, was purchased abroad has proved itself in practice. Today GGG single crystals are being grown in series, and the process is being adapted to deal with more and more substances which are expected to have a great future. This is because the use of single crystals is growing steadily throughout the world.

CSO: 2502

WORK OF NEW LABORATORY OF APPLIED BIOPHYSICS DESCRIBED

Budapest NEPSZABADSAG in Hungarian 19 May 78 p 6

[Interview with Peto Gabor Pal: "The Freshest and the Smallest: in the Applied Physics Laboratory of Budapest Technical University"]

[Text] Since no new independent research institute has been founded in Hungary after April 30 of last year, then the Applied Biophysics Laboratory of the Technical University is the youngest, the freshest Hungarian research institute. At the same time it is truly the smallest. It functions in a few rooms separated--but done over to be perfectly suitable for the purpose--on the first floor of the Krusper St dormitory of the Technical University, and aside from its director, Prof Greguss Pal, Jr. there are in all two high-ranking scientific staff members; the entire institute employs 7 people. It is not easy to clarify the nature of the institute, because there is no other like it; it does not belong to any arm of the Technical University but is only under the rector; it is not a teaching institution, its staff members do not present lectures at the university; it is a research institute although it is called a laboratory.

As far as the "applied biophysics" which serves as its name, this is even harder to put into words with accuracy. There are biophysics institutes in Hungary--for example, the Semmelweis College of Medical Sciences in Budapest, or Pecsett, both of which are held to be the forefront of scholarly learning--but there biological and physics research is being conducted. In one place they are doing research on the biological effects of x-rays through biophysics, in another electrophysiology.

"With one example I can convey best how we interpret the concept of applied biophysics in this laboratory," states Pal. "To reveal a crack in a splint or to reveal a separation of the retina behind a cataracted eye--are both the same problem, because in both cases you must reveal a surface behind a substance that is impregnable to light. The method used for the solution is also the same--ultrasound, for example--and so is the apparatus...only when the instruments have already been worked up, then the one is medical and they put it into a white box, and it takes three times as long as the checking of the splint."

The example says a lot about the topic, and also about the one who is speaking. Pal worked a long time in the Railroad Scientific Research Institute, and then for a part of his nearly 10-year overseas pedagogical and research activities--naturally something he took on with the contribution of the government--as professor of applied biophysics in the ophthalmological institute of the New York Medical College, he took part in the training of specialists, as well as doing research. As professor of the Darmstadt (GDR) Technical College, moreover, he taught physicists, and in the coherence optics section of the Radiation and Environmental Studies Institute he approached these research topics from the side of the physicists.

Our research work here goes on in the field of biology and physics; we study biological characteristics with physical means, so that we can apply the result equally to both biological--that means, medical--and technical fields. We have already a good deal of cooperation with scientific and medical school institutes, as well as common research, and many auditors from these universities are preparing their degree work with us.

[Question] You mentioned ultrasound. It is widely known that you carried on research work in this area a long time ago, and that you served as the trailblazer of ultrasound holography in the specialized literature. Are you now working in ultrasound research?

[Answer] Certainly. It is also true that I had my first success not with laser beams, but with ultrasound in verifying the holography worked out by the Nobel laureate Gabor Denes. Since then I have been occupied with ultrasound research. I am particularly interested in the relationship between laser beams and ultrasound, as this is greater than one might think. Although the laser beam is an electromagnetic oscillation, while ultrasound is mechanical--sound of great oscillation which cannot be perceived by the human ear--they have in common that they are coherent. In this we have reached energy fascicles of such identical oscillation spread thinly, whereby the light or sound waves are in perfect synchony, they are "in step." This is a really interesting property of both these wave-types. For this reason we are doing research on them in parallel: whatever we investigate with lasers we check with ultrasound, and vice versa.

It is true that we are now living through the period of getting settled and are not working at full capacity, but still we already have interesting topics. For example, we are looking for models suitable for the interpretation of the processing of biological information. This sounds abstract like this, so I will explain what I mean with two examples.

It is widely known that the bat orients itself and obtains nourishment with the help of ultrasounds given out by it, reflected, and perceived in the dark. Widely known--but the situation is not quite so simple. Due to the relatively small velocity of the sound, the bat would still only be able to perceive objects more than about a meter and a half away on the basis of measuring the echo, not to mention how he can distinguish between his own sounds and those

of other bats. In addition it has also been established that the bat makes distinctions between squares, triangles, and circles, for example. By virtue of the fact that they are capable of distinguishing distance and shape at the same time it follows that in some way they process the ultrasounds some way with a hologram idea, that is they "see" in three dimensions, in space, by sound. However for us the bat is just a model: it serves for the study of the processing of ultrasound information, which could have practical significance thereafter both in the investigation of materials without damage and in medical diagnostics. Another example. We investigate eye movements with laser equipment. According to one theory the understanding of eye movements gives an explanation as to why, for example, certain forest creatures find one scene favorable and another unfavorable, to be avoided, while from the point of view of forestry the vegetation in both places is identical. The significance of this research in wild animal raising or animal husbandry is clear, but certainly we can consider it usable for understanding in view of the human processing of visual information as well.

The two examples given by Dr Pal are food for thought. A third interesting research topic I saw "with my own eyes." They projected a laser beam on a small screen and by whether or not I thought I saw movement on the surface and in which direction they could tell what defect my eyes have, and what kind of glasses I have to wear. This method--not discovered but adapted--by the Applied Physics Laboratory could become such a quick filter examination procedure in ophthalmology as the x-ray screen filter in chest examinations. "We are examining," the director mentions one more topic of their work, "the effect of laser beams and ultrasounds exercised on biological materials and cells in nonharmful energy-reserves, primarily on the basis of variation in electrical properties.

"A method is under elaboration whereby we can diagram the ultrasound waves reflecting from tissues with an acoustic focusing lens such that they always give a symmetrical 'picture,' by evaluating which--with the proper computer program--one can discover the characterization of the tissue, and thus this research has differential-diagnostic significance.

"We are continuing to work on helographic microscopy. Its aim is not to present a relief picture, but so that by preparing a number of holograms on the same plate we can gain an elucidation of the truly minute physical and chemical changes going on in the microscopic world."

[Question] Are you also trying to introduce laser beams with ultrasound in this area?

[Answer] We still cannot undertake this complicated job, but we hope that we will in a few years. The essence of our work is determined by the name of our laboratory, not so much the word "biophysics" which can be explained in many ways but that it is "applied." I became greatly imbued with the practical view during my years in India, America, and the GDR. The cooperation which remains with my old workplaces, is both commendable, and promises many possibilities.

The youngest and smallest Hungarian research institute began its work in a modern spirit--that is, practical, striving for fulfillment. This promises much, as opposed to its leader, for whom that is certain.

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BRIEFS

JOINTLY DEVELOPED MINICOMPUTER--With the cooperation of the Soviet Union the VIDEOTON Factory will develop a new, high-capacity minicomputer by 1980. As the result of reciprocal parts production and exchange of products between the socialist countries, VIDEOTON has already been able to reduce the percentage of parts imported from capitalist sources to 10 percent. Cooperation, primarily between Soviet and Polish partner enterprises, extends to joint production of peripherals and line printers. The jointly developed SM-52 is referred to as the David of the Ryad system since it will be the largest device in the mini category. Its central memory will have a storage capacity of 1 million symbols and the operating speed of the machine, which incorporates microprocessors, will approximate 1/000th of a second. The SM-52 is being built for many kinds of process control and for data processing. Its efficiency can be enhanced through use of many types of capacity-increasing auxiliary equipment. Joint development work has already begun, and the first models of the computer will be completed in 1980 at Szekesfehervar. [Text] [Budapest MAGYAR HIRLAP in Hungarian 14 Jun 78 p 4]

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NOWACKI CITES PROBLEMS AFFECTING SCIENTIFIC RESEARCH

Warsaw NOWE DROGI in Polish No 5, May 78 pp 5-16

[Article by Witold Nowacki, President of the Polish Academy of Sciences (PAN): "Problems of Effectiveness of Scientific Research"]

[Text] There are many problems of current, critical importance in Polish science. I shall discuss just a few, concentrating on a problem which is the most important in the conviction of the public, top government officials and the scientific community itself: increasing the effectiveness of scientific research and its influence on the development of society.

I fully share the view of Professor Jan Szczepanski that "backward science cannot play any positive role in society." Therefore the first question applies to the level of Polish science. Toward this end I shall endeavor to characterize some of the qualitative changes which are taking place in contemporary science and discuss the state of advance of these changes in our science. I should then like to trace the mechanism of relationships between basic and applied research and broadly-defined technological progress in the example of my own area of scientific specialization -- mechanics. Finally I should like to discuss the conclusions which proceed both from the development trends of contemporary science and from the logic of the research process for scientific policy, and in particular for strengthening the influence of the Polish Academy of Sciences on the development of science and society.

Science exerts an influence not only on the material conditions of societal affairs but also on the consciousness of society. I should also like to point out an important but not always properly appreciated and correctly utilized instrument for raising the scientific and technical cultural level of society, this instrument being a scientific movement on the part of the public.

I

I shall draw attention to four development trends in contemporary science.

The first of these is the deepening process of specialization -- the creation of new, sometimes small subdisciplines and research areas, and on the other hand the process of integration -- the interweaving of a number of independent disciplines. For example, the boundary between organic chemistry, inorganic chemistry and physics is becoming obliterated in large measure; there is taking place enormous development of interdisciplinary research conducted within the framework of comprehensive research programs, by large teams of diversified, mutually-complementing specialists; there is occurring a trend in the direction of synthesizing several areas into a single, generalized theory.

A second characteristic feature of contemporary science is the process of mathematization, which is today encompassing not only the exact and applied sciences but also the biological, medical, agricultural and social sciences, including economics, sociology, and even linguistics. This was followed by the introduction of mathematical machines, connected with which is the development of specialized conceptual languages. Thanks to this all nonlinear problems have become acceptable, problems which are becoming increasingly dominant in contemporary physics, chemistry, mechanics and cybernetics.

A third feature is the penetration of the most recent discoveries and methods of contemporary physics into other disciplines, such as chemistry and biology, as well as a very close link between physics and technology, one expression of which is the increasing use of electronics and automation in production processes, the revolution in telecommunications and transportation, and the development of materials engineering.

The adoption of modern methods of measurement has increased the productivity of reseach in all experimental areas of science. For example, at the present time measurements are linked with the computer which, proceeding from experimental data, immediately presents, for example, the elements of the structure of crystals and molecules. The computer is also coupled with the electron microscope for identification of inclusions in metal alloys, etc. It has become possible to automate measurements and to program an entire cycle of experiments supervised by an automated unit.

A fourth feature is progress in studies of the microworld. One branch of this research applies to the submolecular level and comprises the foundation of development of all nuclear technology, while another encompasses research at the molecular level, promoting molecular biology and molecular chemistry. Molecular biology is opening up new prospects in the field of genetics, including the production of industrial-use microorganisms and the breeding of plants with desired traits, while molecular chemistry has become the foundation for development of plastics.

All trends in contemporary science named here as examples are seen in our country as well. Disciplines which are bearers of cognitive and technical progress have been consciously developed in Poland, as a result of which we are not only capable of keeping our hand on the pulse of the contemporary development of science but also of making our own innovative contribution.

This is so in many areas of mathematics in which we have long been at the state of the art and in which we are capable of holding this position, such as in theory of numbers, general topology (K. Borsuk's theory of form), infinitely dimensional topology, foundations of mathematics, functional analysis (Banach space), theory of approximation, mathematical analysis, differential equations, control theory, theory of probability and stochastic processes. There occurred substantial development of fields of mathematics which previously had been weakly developed in this country: algebraic topology and geometry, mathematical statistics, and dynamic systems. One must very highly rate the influence of the Polish school of mathematics on the development of many areas of science. There have also been many initiatives in the area of direct applications of mathematics. The Mathematics Institute of PAN initiated research and design projects in the 1950's which led to the establishment of a computer industry in Poland.

During that period we were able to bring together at the Institute of Basic Problems of Technology large teams of scientists capable of catching up in the field of solid-state physics, of building a foundation for the development of electronics, and of advancing the development of mechanics and acoustics.

We established in the PAN system, in higher education and at the ministry level large facilities in the field of solid-state physics and nuclear physics at a fairly early date. We obtained many valuable results; as an example we might mention a project dealing with the phenomena of transport of electrons in semiconductors and the results of combined studies of semiconductor compounds with a narrow and zero energy gap, as well as a number of discoveries in the field of nuclear physics, including discoveries pertaining to excited states of hypernuclei, creation of high-temperature plasma, as well as thermonuclear microsynthesis.

Particularly strong development of modern areas of the physical, chemical and biological sciences has taken place in this country in the last seven years. However, we are seriously behind if we consider penetration of the achievements of these sciences and modern measuring methods into applied technology. We are also considerably behind from the standpoint of scientific working conditions. Particularly bothersome is the crowdedness of laboratories, and there is a lack of modern equipment. Attesting to the energy and dynamism of Polish technical thought is the fact that in spite of all this we are developing modern physical methods, bolstered by new analytical methods in the area of electrochemistry and polarography, measuring methods in the area of high vacuums and high pressures, optical spectroscopy, calorimetry, radiospectroscopy and low temperatures. On the whole this creates a promising future for Polish industrial specialization in the area of manufacture of custom scientific research equipment and means of automating research.

Development of the Polish scientific equipment industry is equally essential for accelerating the pace and increasing the effectiveness of scientific

research as well as for the further modernization of industry. In both instances modern research and measuring equipment is of decisive significance. We cannot count, however, on fully meeting present requirements in this area by means of imports, particularly from the hard-currency area. Accelerating development of our own equipment manufacture seems to be the only realistic solution. But this type of industry is one of the most difficult, and it would be a costly and risky enterprise without appropriate international cooperative manufacturing relationships. Therefore we attach fundamental importance to scientific and production cooperation in this area with the Soviet Union and the other socialist countries within the framework of a multilateral agreement between the academies of sciences of our brother countries.

If our evaluation of the cognitive level of our science is positive[1], a question arises: why is its influence on the development of society and particularly on the development of technology still inadequate? I should like to discuss one of the reasons, in my opinion a very important reason, namely the lack of links between basic research, applied research, and development projects, including design projects. I shall endeavor to present a model of such relations in the example of a discipline which is close to me personally -- mechanics of deformed bodies.

II

This discipline breaks down into many subdisciplines, among which an honored place is occupied by theory of elasticity. This theory constitutes the foundation of a number of applied sciences. Suffice it to say that 90% of all structural designs are based on the results of this theory.

The theory of elasticity has been evolving for about 150 years. It would seem that this is a complete theory, to which only new bricks could be added. But this is not the case. Impulses coming from development of physical research as well as impulses coming through advances in technology (increasingly g r e a t e r speeds attained in flight, operation of machine parts at elevated temperatures, effect of streams of neutrons on reactor housings, etc) are causing theory of elasticity to be in a period of rapid development, particularly in the last 20 years. It is linked with other fields, with a temperature field, an electromagnetic field, a concentration field or chemical potential. New areas of research are arising, lying at the crossroads of fields which in the past developed independently. There was operating 20 years ago in mechanics of continuous deformed media a division into theory of elasticity and plasticity. In the course of these years there have developed new fields expanding the above-listed areas, such as viscoelasticity, viscoplasticity, and rheology. There have also developed many areas which are combined with certain areas of phenomenological physics: thermoelasticity -- as synthesis of theory of elasticity and theory of thermal conductivity, as well as magnetoelasticity -- as a link between theory of elasticity and electrodynamics.

On the other hand, nonlinear theory of elasticity, which studies large finite deformations of a body, is evolving rapidly. Electronic computer hardware is helping in this development. Computers make it possible to solve problems which only a few years ago were set aside due to insuperable computing difficulties.

New ideas and new methods are being born on the soil of such a broadly-conceived theory of elasticity. Effects taking place in liquid crystals have been elucidated and new effects have been discovered in dielectrics with piezoelectric properties thanks to the link between theory of elasticity and electrodynamics. The sciences of biomechanics and rheology are developing.

The team conducting research in the area of theory of elasticity is not homogeneous. They are for the most part mathematicians, as well as experts in mechanics and theoretical physicists. The mathematicians construct the mathematical foundations. Incidentally, the mathematical problems of theory of elasticity have enriched certain branches of mathematics such as theory of partial differential equations, theory of integral equations, and theory of functions of complex variables. On the other hand mathematicians of the status of Fredholm, Lauricello, Weyl, Lichtenstein, and Muszeliszwili have made a significant contribution to theory of elasticity.

A second group -- theoretical physicists -- works chiefly with problems of coupling the strain field with other fields (temperature, electromagnetic). They have developed modern areas of theory of elasticity.

Finally we come to the specialists in mechanics. Their research focuses on development of theories connected with the properties of matter (visco-elastic, anisotropic, etc) as well as the solving of boundary problems, and construction of approximate methods (variational, differential) permitting description of complex problems in the simplest possible manner.

The basic research described here is carried out for the most part at universities (in this country at the University of Warsaw) and at institutes, such as the PAN Institute of Fundamental Problems of Technology and at some technical schools.

The broadly-defined theory of elasticity has its practical extension in applied research conducted within the framework of so-called science of strength of materials, in structural mechanics, and finally in theory of steel, bridge, ship, aircraft structures, etc.

The science of strength of materials is, as it were, a vulgarized, simplified theory of elasticity translated into the language of engineering. Three-dimensional problems of superficial beams (plates, slabs, shells) are reduced to two-dimensional problems, and to one-dimensional problems in the case of rods. The mathematical edifice of the science of strength of materials and theory of structures is substantially more modest and does not go beyond elements of mathematical analysis. It is applied to statistical and dynamic computations for machines and structures of all types.

The science of strength of materials, structural mechanics and theory of numerous types of structures are applied sciences, practiced primarily by researchers recruited from among engineers and scientists working at polytechnic schools as well as ministerial scientific institutes. In my discipline applied research involves 85% of manpower and funding, while basic research involves 15%.

I should emphasize that different groups of researchers work in basic and applied research as well as on design projects. It rarely happens that one person works simultaneously in all these areas. In construction Franciszek Szelagowski (designer of the Slasko-Dabrowski Bridge in Warsaw) and Zbigniew Wasiutynski (reinforced concrete bridges and building structures) succeeded in doing this with outstanding success.

Designers in turn utilize the applied research discussed here. These comprise a group of enlightened engineers possessing considerable professional knowledge and well-developed design sense. Generally they do not engage in applied research but make use of all available scientific materials (textbooks, manuals, solution models, standards, scientific and technical journals). They keep up on scientific and technological advances and incorporate them into their design.

Their outstanding works (certain bridges, masts, towers) are examples of engineering art, which are also works of beauty. The profession of designer is a fine and honorable profession, which requires not only knowledge but also imagination, ingenuity, and creative intuition, for designers are many times faced with new problems, which must be quickly solved to meet deadlines, based on the designer's own experience and intuition. Up to the present time, for example, there is a lack of a complete theory of mechanical oscillations of high masts with guy wires. In spite of this, the world's tallest radio transmitter antenna was built in Konstantinov, and its oscillations were experimentally observed following completion of construction.

Consequently we have three types of activity: basic research, applied research, and development projects, including design projects. Each of them has different representatives. Basic research is conducted by specialists in mechanics, mathematicians and theoretical physicists; applied research is conducted by specialists in mechanics with a technical education, and design projects are conducted by enlightened engineers. Essentially these specialized groups cannot be combined or exchanged: each of them, as in a relay race, runs its own leg and must independently perform the tasks in its area; each demands differentiated predispositions, proclivities, abilities and training. But there must exist a continuous, two-directional flow of ideas, knowledge, and inspiration. Often, for example, designers present problems to researchers: operation of steam turbines at higher and higher temperatures, buckling of shell structures, self-excited oscillations in suspension bridges in an aerodynamic wind flow, airplane wing flutter -- these are some of the problems presented by designers to research scientists.

Not everybody understands this long and complicated road of scientific and technological advance, a road which requires the accumulation of scientific knowledge as well as the special talents and practical abilities of a great many people representing very different scientific and professional areas of specialization. Nor can everybody see in a certain structure or product the contribution of scientific theory, or distinguish between the creative contribution of the applied sciences and the creative contribution of the designer, which only in very few instances can be called scientific creativity.

The above-mentioned difficulties are the source of many oversimplifications and misunderstandings. A capable designer must be appreciated and respected for that which he does, which possesses independent value. The designer's work does not need to be upvalued by artificially calling it a scientific achievement; one of the most socially valuable professional titles -- mechanical engineer, designer, architect, etc -- does not require the addition of or bolstering by a scientific title.

There exists a tendency to use the designation scientific not only in the case of outstanding engineering achievements but also ordinary, routine activities, as a consequence of which there occurs depreciation of the term scientific creativity, technical innovation, invention, and efficiency innovation. Yet each of these types of creativity is of enormous importance, and only their sum total combines to form scientific and technological advances, that desired and socially useful "final product."

Of course it sometimes happens that in the above-described chain of interrelationships, one of the links is either weak or entirely lacking. For example, theorists may be absent, and the "bridge will not collapse" if there are good designers. But good designers cease to be good if they fail to keep up with advances in theory, which is assimilated through the mediation of the appropriate applied sciences. Most frequently there is a lack of good designers, and then voices speak out demanding the "transfer" of representatives of applied research and even theoretical research to their place. These demands are neither right nor realistic. A good theorist is able to teach a good designer but is unable to replace him. Solution to the problem of a shortage of a given group of specialists lies in raising the level of their training at polytechnic schools and in better utilization of outstanding scientific cadres toward this end. If, however, the country lacks excellent scientific cadres in a specified area, they must be trained abroad, at educational institutions which represent a high level of achievement.

III

How are the development trends of contemporary science mentioned in the introductory section as well as the logic of the process of research and project adoption activities, described with the example of mechanics, reflected in scientific policy, in the research planning and financing system and in the organizational structures of science?

Thanks to implementation of the strategy specified at the Sixth and Seventh PZPR congresses, the 1970's have become a highly positive period for Polish science. Broadening of prospects, increase in the scale of ambition and acceleration of the pace of socialist development has greatly increased the role of science, boosting the prestige and strengthening the status of scientific personnel. A favorable climate has been created, considerably greater resources have been secured, and the organizational system has been improved. Once again I emphasize the fundamental significance of the Second Polish Scientific Congress in this area.

An unquestioned achievement of the 1970's was the establishment of large, both in relation to our conditions and capabilities, combined research programs. Such programs as (naming them in abbreviated form) "coal," "copper," "water," "protein," "housing," "electronics technology," assigning tasks to our nation's entire scientific potential which are especially important to Poland. They are planned in complete cycles, that is, in all elements of the research process. Productive, multidiscipline research teams have been established for these programs, teams which constitute a new and valuable phenomenon in this country.

However, this desired concentration and integration of scientific and technical facilities has been achieved only in some programs, while in many others we are dealing with only apparent integration, with various research teams and individual research scientists artificially "written into" the program, with subject matter actually -- in spite of promising verbal formulations -- in a loose link with the principal goal of the specified program.

The positive effects of the new planning system are also weakened as a consequence of errors in distributing finances, personnel and equipment. In addition, acquisition and utilization of these funds is wrapped up in so many conditions and demands which are incomprehensible to the researcher that as a consequence funds do not come in a timely manner into the hands of those who could use them most effectively. Excessive formalism and bureaucracy are perhaps the most dangerous disease at the present time. Sometimes a small cash subsidy or assignment of a few personnel to an outstanding scientist would be sufficient to achieve substantial results,[2] while at the same time considerable funds are wasted as a consequence of failure to respond to the recommendations of self-governing learned bodies, common carelessness or a lack of vision on the part of various decision-making officials.

In this manner we lose an important trump card: the possibility of utilizing the best personnel, the possibility of speeding up research where we encounter a method of solving some important scientific or technical problem, as well as withdrawal from a given path if it does not lead to the goal. The sooner we get rid of those factors which impede the system of financing and management, which make it impossible to respond flexibly to those situations which are typical in creative research activities, the better it will be for science and the economy.

A three-level structure of science formed in this country in the 1950's: higher schools, facilities of the Polish Academy of Sciences, and ministry institutes, together with the research and development facilities of enterprises and plants operate in parallel. A similar organizational structure exists in other socialist countries as well as in capitalist countries,[3] which attests to its suitability. However, within the framework of the above-described organizational structure in the most highly-developed countries, fundamental changes are taking place, and functional links are becoming stronger. And yet in this country the inflexibility of institutional divisions sometimes even becomes greater, while ratios in the distribution of scientific potential remain for years without substantial changes. One third of scientific personnel of the corresponding areas of specialization are employed in research and development, while two thirds are employed at higher schools. And yet in the scientifically and industrially most highly-developed countries more than half of total scientific personnel are employed in the ministry sector. Cadre strengthening of this area, particularly research and development facilities of factories and enterprises, would seem to be at the present time an essential condition for establishing stronger links between science and technology. It is necessary at the same time to avoid creating in this area new research facilities without genuine research personnel, thus creating a harmful fiction.

The growth rate in the area of PAN facilities is too slow. From the standpoint of growth and development of the system, size of work force as well as up-to-dateness of equipment, they are inferior to the institutes of the academies of sciences of other socialist countries, including Czechoslovakia and the GDR. We must not only adjust overall proportions but also enlarge the network of facilities and modernize their equipment in individual areas. We know from our own experience and that of others that valuable cognitive and practical results are obtained faster and more surely in mixed teams (that is, grouping specialists from different disciplines, as well as engineers and technicians) of fairly large "critical mass," supplied with modern equipment and, what is very important, working in direct contact with industry.

Scientific-production centers have been established in recent years in this country as well, gathering together "under a single roof" or in a single organizational area a scientific institute, a design office, an experimental plant, and a production plant.[4] This is the trend of the future, which is being employed only in a few areas, and in addition demands heavy capital investment. For these reasons, in the present and next decade the point of emphasis will rest on functional integration of the existing three areas. This means deepening of their ties and cooperation based on excellent research and corporation programs as well as an easier flow of personnel as well as ideas and creative concepts.

During the present term in office of PAN officers we want to achieve broadening and deepening of cooperation with higher education and the ministry area.

The system of administration at the central and ministry level, however, should promote attaining this objective to a greater degree. It is a promising indication that this problem is on the plenum agenda of our party's Central Committee.

IV

One of the fundamental conditions for increasing the influence of science on the development of society is greater concern for quality of personnel at all levels of the research and incorporation process. In short, we need more scientists capable of constructing scientific theories and making scientific discoveries, as well as more engineers and technicians capable of their innovative transformation into new technologies, materials, designs, equipment and objects of everyday use. We also need more enthusiasts in the area of technical and organizational advances within work forces in order that innovations can be put into mass production more rapidly, with product quality improving rather than deteriorating. Finally, increased scientific and technical knowledgeability on the part of the public as a whole is essential, since this determines efficient utilization of the production base and efficient utilization of all products.

It is also necessary to increase the influence of self-governing scientific bodies on decisions made in matters of science at various levels of management and administration.

As we know, the Polish Academy of Sciences is this country's highest scientific institution, a regular adviser to the government in matters of science, and at the same time a self-governing organization of scientists. PAN unites eminent scientists for the purpose of creative scientific activity and has at its disposal an elaborate network of facilities and scientific committees, which enables it to make competent and authoritative statements on the subject of the directions of development, the status and needs of Polish science in its aggregate as well as on establishment and development of a system of scientific counsel for the needs of this country's political and government leaders. The Academy has made significance achievements in this latter area (the finest example is the Report on the State of Education). We must state at the same time that some expert studies are neither penetrating nor bold, limiting their probes to generally-known points. On the other hand sometimes the authors of a study have no idea of its subsequent fate or do not sufficiently participate in translating studies into the language of decisions and practical actions.

The extensive network of corporative bodies in the Academy, at higher educational institutions (senates and departments) as well as in ministries (scientific-technical councils) is not sufficiently incorporated into the system of planning, administration and management of science and technology at the central level, at the level of ministries and associations, and even at the level of scientific facilities, as is attested by the actual decline in the role and activeness of scientific councils at scientific establishments.

The harmfulness of this state of affairs is obvious, but efforts to correct this abnormal situation encounter many difficulties. Public advisory bodies are most frequently formed on the principle of representation of individual disciplines, while research programs and more and more scientific establishments are of a combined, interdisciplinary character; complex socioeconomic problems in turn do not entirely match either the ministry or branch system, nor the classification of the sciences. This makes it difficult for decision-making officials to translate fragmentary opinions and expert evaluations into unequivocal decisions in the area of development priorities, distribution of funds, etc.

We have definitely too many advisory bodies and coordinating entities, the membership of which is overlapping to a substantial degree, and the areas of competence of which overlap or mix, while decisions in fact are made beyond this entire formalized structure. The problem does not boil down merely to bringing order and harmony to the system, the areas of responsibility and competence of these bodies, nor does it end with finding a way to link administrative and nonadministrative forms of administration and management of science. Essentially the problem goes much deeper -- down to the social roots of the forming of scientific opinion and the social conditions of optimization of decision-making processes.

Science is a major public business. Its status, development, achievements and needs should be publicly discussed, for only under conditions of public monitoring and responsibility for views expressed can correct decisions be born. But debate and scientific criticism are requisite not only from the standpoint of the needs of guiding the development of science. It is an essential condition for the development of science itself. The advance of knowledge takes place in the process of continuous reevaluation of achievements. And yet the state of scientific criticism in Poland arouses justified concern: there is a lack of public debate, with scientific debate occurring only within the covers of scholarly journals, nor does the scientific community respond to views expressed under the name of science which are contrary to scientific method and a scientific philosophy, as well as to voices of criticism directed toward science as a whole, specific scientific areas or establishments.

We must be concerned not only with satisfying the material needs of society but also its spiritual and intellectual requirements as well. The public scientific movement, if its potential were adequately appreciated and intelligently utilized, could also decisively promote satisfaction of these needs and raising of the general level of scientific and technical knowledge on the part of the public. We have more than half a million volunteer activists organized into scientific, general and specialist societies, in scientific and technical societies associated in the Chief Technical Organization, in scientific-professional organizations (medical, for example), in student scientific circles, as well as the Society for the Dissemination of Knowledge and other sociocultural organizations.

One important task of the Polish Academy of Sciences is supervision of this movement, which has considerable achievements to its credit.[5] We need greater assistance and concern both on the part of local authorities, which should esteem and appreciate the valuable elements of this movement: spontaneity of initiative, independence and genuineness of voluntary action. Increased assets as well as improved coordination of activities, particularly in the area of popularization of science and a scientific philosophy can substantially boost the effectiveness of the activities of scientific societies. The specific character and role of scientific societies should find expression in a legal status which is better adapted to the type of their activity than at the present time.

The Polish Academy of Sciences, both on the basis of the requirements of law and its actual capabilities, is making and will continue to make efforts to bring science to the public at large. It is acting directly -- through its contacts, establishments, scientific and popular-scientific publishing houses, as well as the Polish Academy of Sciences University, which gives the public, and young people in particular , the opportunity for direct contact with outstanding scientists. It acts directly -- by providing inspiration to the press and electronic media, as well as evaluation of those extensive and diversified activities in the area of popularization of science, initiation of studies of the effectiveness of science, and improved adaptation of areas and methods of action to the actual needs of society.

We want to obtain new allies. What I have in mind here is closer cooperation with the scientific-technical societies associated in the Chief Technical Organization, with which we are bound b y an appropriate agreement and program of joint undertakings, with the Society for the Dissemination of Knowledge, and with the central student movement as well as the public cultural movement.

We are placing our hopes on activists in the student scientific circles. Many of them maintain close contacts with their home areas, and more and more of them can become, upon completion of their studies, activists of scientific societies and other entities of the public scientific and cultural movement in their home areas, helping to ensure that scientific and technical knowledge reach small localities and places of employment.

With the steadily growing influence of Marxist methodology on all branches of science, particularly the social-humanist disciplines, the possibility of existence of different schools and trends and freedom of scientific expression constitutes a fine tradition and foundation for the development of science in People's Poland. Party policy and Academy activities aim at forming a unity and solidarity of scientists. Any attempts to change, and particularly to destroy this state of affairs would be harmful, and scientific establishments must offer resolute resistance to such efforts. This applies both to scientific research and teaching activities and to the scientific and student movement, in which there are no reasons whatsoever to establish new organizations for the purpose of opposing existing forms of activity, which are continuously improving.

Removing the numerous barriers and obstacles which still exist, intensifying basic and applied research, linking up with technical and organizational advances, with the innovative activities of enlightened engineers and progressive work forces, and stepping up activities in the area of popularization of science and a scientific philosophy -- we seek to proceed in a broader front and more effectively toward the goal specified by the Sixth and Seventh congresses: raising of the living standards and quality of life of the people as a whole and of each individual citizen.

FOOTNOTES

1. I encourage interested persons to study the materials and documents of the Second Polish Scientific Congress, published in several large volumes in 1974 by the Ossolinski National Institution.

2. In the programs of activities of PAN during the term in office of the present officers,,we specified the possibility of establishing so-called academic groups, enabling productively-working members of the PAN to intensify their research activities; we are also developing other forms of promoting scientific activity, including through stipends and patronage of scientifically gifted young students, a system of subsidization of research, and a system of scientific competitions and prizes.

3. In addition to higher education, in some capitalist countries one can distinguish an area of industrial research institutes (for example, Philips, IBM, Du Pont, Western Electric), which are analogous to our ministry institutes, while on the other hand there exists an area of basic research institutes, which are controlled, however, not by academies of science but by separate government institutions, such as the Centre National de la Recherche Scientifique in France, the Consiglio Nazionale delle Ricerche in Italy, or the Max-Planck Gesellschaft in the FRG.

4. For example, the Semiconductor Research Center, which includes the Electronics Technology Institute and the Tewa Semiconductor Plant; in like manner the Institute of Heavy Chemical Synthesis in Blachownia is linked to a chemical plant in Kedzierzyn, and the Institute of the Industry of Construction Binding Materials is linked to a cement plant in Opole.

5. The achievements of scientific societies were summed up in a report prepared by PAN, which merits broader dissemination.

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